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Practitioner's Docket No. 5181-10802 **PATENT**
Client Docket No. P3045C2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

December 22, 1998

Assistant Commissioner for Patents
Washington, D.C. 20231

BROADENING REISSUE APPLICATION TRANSMITTAL

Transmitted herewith is the application for reissue of U.S.

☒ Utility Patent ☐ Plant Patent ☐ Design Patent

Patent No.: 5,588,139

Issue Date: December 24, 1996

Inventor(s): Jaron Z. Lanier, Jean-Jacques G. Grimaud, Young L. Harvill, Ann Lasko-Harvill, Chuck L. Blanchard, Mark L. Oberman, Michael A. Teitel

Title: METHOD AND SYSTEM FOR GENERATING OBJECTS FOR A MULTI-PERSON VIRTUAL WORLD USING DATA FLOW NETWORKS

Enclosed are the following:

1. Specification, claim(s) and drawing(s) (37 C.F.R. § 1.173)
   (a) ☒ 1737 page(s) of specification (1725 pages of appendix)
   ☒ 13 page(s) of claims (with newly added broadening claims underlined)
   ☒ 1 page(s) of abstract

CERTIFICATION UNDER 37 C.F.R. § 1.10*
(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this Reissue Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date December 22, 1998, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL091342152US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Roger Combs

(b) ☐ _____ sheet(s) of drawing (drawings amended)

☐ Formal

☐ Informal

☒ No changes in the drawings, upon which the original patent was issued, are to be made. Therefore, in accordance with 37 C.F.R. § 1.174(a), please find attached, in the size required for original drawings:

☒ 7 sheets of copied printed drawings from the patent.

☐ a photoprint of the original drawings.

☐ A letter requesting transfer of the drawings from the original patent file to this reissue application is attached

2. Declaration and power of attorney

☐ _____ pages of declaration and power of attorney

3. Preliminary amendment

☐ Attached

4. Offer to surrender the original letters patent in accordance with 37 C.F.R. § 1.178:

☐ Offer to surrender is by the inventor

☐ along with assent of assignee.

☐ Offer to surrender is by the assignee of the entire interest (and the reissue application does not seek to enlarge the claims of the original patent).

5. Letters patent

☐ Original letters patent are attached.

☐ Declaration that original letters patent lost of inaccessible is attached.

☒ A copy of the original printed patent is attached.

6. Petition to proceed without assignee's assent

☐ Attached hereto is a "PETITION TO PROCEED WITH REISSUE APPLICATION WITHOUT ASSIGNEE'S ASSENT".

A. ☐ The fee payment is authorized in the attached:

☐ "REISSUE APPLICATION TRANSMITTAL" Form

☐ "COMPLETION OF FILING REQUIREMENTS - REISSUE APPLICATION" Form.

B. ☐ Payment is authorized below.

7. Information Disclosure Statement

☐ Attached

☐ Copies of the IDE citation(s) is/are attached.

8. Priority - 35 U.S.C. § 119

☐ Priority of application Serial No. 0 /_____, filed on _____ in _____ is claimed under 35 U.S.C. § 119.
Country

☐ The certified copy has been filed in prior application Serial No. 0 / _____ filed on _____

9. Basic Filing Fee Calculation (37 C.F.R. § 1.16(h), (I) and (j)

CLAIMS AS FILED				
	Number Filed	Number Extra	Rate	Basic Fee (37 C.F.R. 1.16(h)) $760.00
Total Claims (37 C.F.R. 1.16(j))	89	- 20 (and also in excess of total claims in patent)	X $18.00	$1242
Independent Claims 37 C.F.R. § 1.16(i))	7	- 3 (number of independent claims in patent)	X $78.00	$312
		Filing fee calculation		$2314

10. Small Entity Status (if applicable)

☐ A statement that this filing is by a small entity is ☐ attached.

Filing Fee Calculation (50% of above) $_____

11. Additional Fee Payments

☐ Payment is being made for "PETITION TO PROCEED WITH REISSUE APPLICATION WITHOUT ASSIGNEE" (37 C.F.R. § 1.17(h))……$130.00

12. Total Fees Due

Filing Fee	$ 2314
Petition Fee	$_____
Total Fees Due	$ 2314

13. Method Of Payment of Fees

☒ Enclosed is a check in the amount of $ 2314.

☐ Charge Account No. _____ in the amount of $_____.
A duplicate of this request is attached.

14. Authorization To Charge Additional Fees

☒ If any fees are due, the Commissioner is authorized to charge said fees to Conley, Rose, & Tayon, P.C. Deposit Account No. 03-2769/5181-10802/DRC.

15. Additional Enclosures

Respectfully submitted,

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Date: December 22, 1998

What is claimed is:

1. A simulating apparatus comprising:

modeling means for creating a model of a physical environment in a computer database;

first body sensing means, disposed in close proximity to a part of a first body, for sensing a physical status of the first body part relative to a first reference position;

second body sensing means, disposed in close proximity to a part of a second body, for sensing a physical status of the second body part relative to a second reference position;

first body emulating means, coupled to the first body sensing means, for creating a first cursor in the computer database, the first cursor including plural first cursor nodes and emulating the physical status of the first body part, the first body emulating means including a first point hierarchy and a first data flow network, the first point hierarchy for controlling a shape and an orientation of the first cursor and for attaching each of the plural first cursor nodes hierarchically with at least one other of the plural first cursor nodes, the first data flow network for controlling motion of the first cursor and the first data flow network including a first interconnection of first input units, first function units and first output units, the first input unity receiving the physical status of the first body part, each first function unit including at least one input and at least one output and calculating, based on the at least one input, a value for each of the at least one output, and the first output units for producing position and orientation values for a portion of the plural first cursor nodes;

first integrating means, coupled to the modeling means and to the first emulating means, for integrating the first cursor with the model;

second body emulating means, coupled to the second body sensing means, for creating a second cursor in the computer database, the second cursor including plural second cursor nodes and emulating the physical status of the second body part, the second body emulating means including a second point hierarchy and a second data flow network, the second point hierarchy for controlling a shape and an orientation of the second cursor and for attaching each of the plural second cursor nodes hierarchically with at least one other of the plural second cursor nodes, the second data flow network for controlling motion of the second cursor and the second data flow network including a second interconnection of second input units, second function units and second output units, the second input units receiving the physical status of the second body part, each second function unit including at least one input and at least one output and calculating, based on the at least one input, a value for each of the at least one output, and the second output units for producing position and orientation values for a portion of the plural second cursor nodes; and

second integration means, coupled to the modeling means and to the second body emulating means, for integrating the second cursor with the model.

2. The apparatus according to claim 1 further comprising first model display means for displaying a view of the model.

3. The apparatus according to claim 2 wherein the first model display means includes view changing means for changing the view of the model in response to a change in the physical status of the second cursor in the model.

4. The apparatus according to claim 3 wherein the second cursor includes a first optical axis which moves together therewith, and wherein the view of the model produced by the first model display means corresponds to the view taken along the first optical axis.

5. The apparatus according to claim 4 wherein the first model display means displays the first cursor together with the model when the first optical axis faces the location of the first cursor.

6. The apparatus according to claim 5 wherein the first cursor depicts the first body part being emulated.

7. The apparatus according to claim 1 wherein the model includes a virtual object, and further comprising first object manipulating means, coupled to the first body emulating means, for manipulating the virtual object with the first cursor in accordance with corresponding gestures of the first body part.

8. The apparatus according to claim 7 further comprising second object manipulating means, coupled to the second body emulating means, for manipulating the virtual object with the second cursor in accordance with corresponding gestures of the second body part.

9. The apparatus according to claim 8 further comprising first model display means for displaying a view of the model.

10. The apparatus according to claim 9 wherein the first model display means includes view changing means for changing the view of the model in response to a change in the physical status of the second cursor in the model.

11. The apparatus according to claim 10 wherein the second cursor includes an optical axis which moves together therewith, and wherein the view of the model corresponds to the view taken along the optical axis.

12. The apparatus according to claim 11 wherein the first model display means displays the first cursor together with the model when the optical axis faces the location of the first cursor.

13. The apparatus according to claim 12 wherein the first cursor depicts the first body part being emulated.

14. The apparatus according to claim 13 wherein the first model display means displays the second cursor together with the model when the optical axis faces the location of the second cursor.

15. The apparatus according to claim 14 wherein the second cursor depicts the second body part being emulated.

16. The apparatus according to claim 15 further comprising second model display means for displaying a view of the model, the view of the model changing in response to the physical status of the first cursor in the model.

17. The apparatus according to claim 16 wherein the first cursor includes a second optical axis which moves together therewith, and wherein the view of the model produced by the second model display means corresponds to the view taken along the second optical axis.

18. The apparatus according to claim 17 wherein the second model display means displays the second cursor together with the model when the second optical axis faces the location of the second cursor.

19. The apparatus according to claim 18 wherein the first body part is a part of a body of a first human being.

20. The apparatus according to claim 19 wherein the first model display means comprises a first head-mounted display.

21. The apparatus according to claim 20 wherein the first head-mounted display comprises:

a first display for displaying the model to a first eye; and

a second display for displaying the model to a second eye.

22. The apparatus according to claim 1 wherein the first and second displays together produce a stereophonic image.

23. The apparatus according to claim 21 wherein the first head-mounted display further comprises:

a first audio display for displaying a sound model to a first ear; and

a second audio display for displaying the sound model to a second ear.

24. The apparatus according to claim 21 wherein the first and second displays display the model as a series of image frames, and wherein the model display means further comprises frame synchronization means, coupled to the first and second displays, for synchronizing the display of the series of frames to the first and second displays.

25. The apparatus according to claim 19 wherein the second body part is a part of a body of a second human being.

26. A simulating apparatus comprising:

a modeling means for creating a virtual world model of a physical environment in a computer database;

a first sensor for sensing a first real world parameter;

first emulating means, coupled to the first sensor for emulating a first virtual world phenomenon in the virtual world model, the first emulating means including a first point hierarchy and a first data flow network, the first point hierarchy for controlling a shape and an orientation of a first cursor, including plural first cursor nodes, and for attaching each of the plural first cursor nodes hierarchically with at least one other of the plural first cursor nodes, the first data flow network for controlling motion of the first cursor and the first data flow network including a first interconnection of first input units, first function units and first output units, the first input units receiving the physical status of the first body part, each first function unit including at least one input and at least one output and calculating, based on the at least one input, a value for each of the at least one output, and the first output units for producing position and orientation values for a portion of the plural first cursor nodes;

a second sensor for sensing a second real world parameter; and

second emulating means, coupled to the second sensor, for emulating a second virtual world phenomenon in the virtual world model, the second emulating means including a second point hierarchy and a second data flow network, the second point hierarchy for controlling a shape and an orientation of a second cursor, including plural second cursor nodes, and for attaching each of the plural second cursor nodes hierarchically with at least one other of the plural second cursor nodes, the second data flow network for controlling motion of the second cursor and the second data flow network including a second interconnection of second input units, second function units and second output units, the second input units receiving the physical status of the second body part, each second function unit including at least one input and at least one output and calculating, based on the at least one input, a value for each of the at least one output, and the second

output units for producing position and orientation values for a portion of the plural second cursor nodes.

27. An apparatus according to claim **21**, wherein the first body sensing means includes a facial expression sensor using conductive ink.

28. An apparatus according to claim **1**, wherein the first body sensing means includes a facial expression sensor including a strain gauge.

29. An apparatus according to claim **1**, wherein the first body sensing means includes a pneumatic input device.

30. A simulating method, comprising the steps of:

creating a virtual environment;

constructing virtual objects within the virtual environment using a point hierarchy and a data flow network for controlling motion of nodes of the virtual objects wherein the step of constructing includes

attaching each node of the virtual objects hierarchically with at least one other of the nodes to form the point hierarchy, each of the nodes of the virtual objects having a position and an orientation, and

building the data flow network as an interconnection of input units, function units and output units, wherein said input units receive data from sensors and output the received data to at least one of said function units, wherein each of said function units includes at least one input and at least one output, each function unit generating a value for the at least one output based on at least one of data received from at least one of the input units and data received from an output of at least one other of said function units, and wherein the output units generate the position and the orientation of a portion of the nodes of the virtual objects;

inputting data from sensors worn on bodies of at least two users;

converting the inputted data to position and orientation data;

modifying by using the data flow network, the position and the orientation of the nodes of the virtual objects based on the position and orientation data;

determining view points of said at least two users;

receiving a synchronization signal;

calculating image frames for each eye of each of said at least two users;

displaying the image frames to each of said eyes of said at least two users;

obtaining updated position and orientation values of said at least two users;

determining if the virtual environment has been modified;

redefining positions and orientations of the nodes of the virtual object if the virtual environment has been modified;

recalculating the image frames for each of said eyes of said at least two users; and

displaying the recalculated image frames to each of said eyes of said at least two users.

* * * * *

31. A computer software program embodied on a computer-readable medium, wherein the software program comprises a plurality of instructions, wherein the plurality of instructions are configured to:

process a first set of data from a first body sensor, wherein the first set of data represents the physical status of a part of a first body relative to a first reference point;

process a second set of data from a second body sensor, wherein the second set of data represents the physical status of a part of a second body relative to a second reference point;

emulate the first body in the three-dimensional environment by changing one or more attributes of a first cursor, wherein the first cursor comprises a first plurality of nodes configured as a first point hierarchy;

emulate the second body in the three-dimensional environment by changing one or more attributes of a second cursor, wherein the second cursor comprises a second plurality of nodes configured as a second point hierarchy;

position the first cursor and the second cursor within a virtual environment; and

integrate the first cursor and the second cursor and the virtual environment into a database.

32. The computer software program as recited in claim 31, wherein the plurality of instructions are further configured to move two or more of the nodes in response to the first set of data indicating that one point in the hierarchy moved.

33. The computer software program as recited in claim 31, wherein the virtual environment comprises both visual objects and non-visual objects.

34. The computer software program as recited in claim 33, wherein the non-visual objects comprise auditory objects.

35. The computer software program as recited in claim 33, wherein the first reference point and the second reference point are the same point.

36. The computer software program as recited in claim 31, wherein the second set of data is received across a network.

37. The computer software program as recited in claim 36, wherein the network comprises one of the following: an Ethernet link, a phone line link, an ISDN link, or a satellite link.

38. The computer software program as recited in claim 31, wherein the virtual environment is three-dimensional.

39. The computer software program as recited in claim 31, wherein the plurality of instructions are further configured to create the virtual environment.

40. The computer software program as recited in claim 31, wherein the plurality of instructions are further configured to load the virtual environment from a storage device.

41. The computer software program as recited in claim 31, wherein the plurality of instructions are further configured to load the virtual environment from a storage device.

42. The computer software program as recited in claim 31, wherein the cursors depict non-humanoid structures.

43. The computer software program as recited in claim 31, wherein the first cursor depicts a human figure.

44. The computer software program as recited in claim 31, wherein each cursor depicts an separate object selected from the group comprising: machines, articles of manufacture, animals, molecules, human figures, human body parts, tools, and three-dimensional objects.

45. The computer software program as recited in claim 31, wherein the first point hierarchy controls the shape and orientation of the first cursor, and wherein the second point hierarchy controls the shape and orientation of the second cursor.

46. The computer software program as recited in claim 45, wherein the motion of the first cursor and the first cursor's plurality of nodes are governed by a data flow network.

47. The computer software program as recited in claim 31, wherein said second body is remotely located.

48. The computer software program as recited in claim 31, wherein at least part of said database is configured to be remotely located.

49. The computer software program as recited in claim 31, wherein said plurality of instructions are configured to be executed by a central processor that sends image frames to said first body and said second body, wherein said first body and said second body are remotely located relative to each other.

50. The computer software program as recited in claim 31, wherein the database is configured to be shared by multiple instances of said software program executing in remote locations connected by linking technology.

51. The computer software program as recited in claim 31, wherein the software program is configured to be executed in two or more remote locations simultaneously, wherein the two or more remote locations are coupled by linking technology.

52. The computer software program as recited in claim 51, wherein the database is shared between the two or more locations.

53. The computer software program as recited in claim 51, wherein the database is duplicated at each of the two or more locations.

54. The computer software program as recited in claim 51, wherein the plurality of instructions is configured to compress communications between the two or more locations.

55. The computer software program as recited in claim 51, wherein the plurality of instructions is configured to share images between the two or more locations.

56. The computer software program as recited in claim 31, wherein the behavior of said cursors in said virtual environment is constrained by the laws of physics.

57. The computer software program as recited in claim 31, wherein the plurality of instructions are configured to superimpose prerecorded behavior on the models.

58. The computer software program as recited in claim 31, wherein the plurality of instructions are configured to algorithmically derive at least part of the said first and second sets of data.

59. The computer software program as recited in claim 31, wherein the first and second sets of data are non-real-time.

60. The computer software program as recited in claim 31, wherein the first and second sets of data are non-real

61. The computer software program as recited in claim 31, wherein the first set of data represents changes in the orientation of the part of the first body relative to the first reference point.

62. The computer software program as recited in claim 31, wherein the first set of data represents changes in the position of the part of the first body relative to the first reference point.

63. The computer software program as recited in claim 31, wherein the first set of data represents changes in the shape of the part of the first body relative to the first reference point.

64. The computer software program as recited in claim 31, wherein the plurality of instructions are further configured to generate three-dimensional sounds.

65. The computer software program as recited in claim 31, wherein the first point hierarchy and the second point hierarchy are different part of a single point hierarchy.

66. A kit for creating an interactive, multi-user virtual reality world, the kit comprising:

two or more body part sensing means, each configured to be worn by a separate body; and

a computer software program embodied on a computer-readable media, the program comprising a plurality of instructions, wherein the instructions are configured to:

process a first set of data from the first body part sensor, wherein the first set of data represents the physical status of a first part of a first body relative to a first reference point;

process a second set of data from the second body part sensor, wherein the second set of data represents the physical status of a second part of a second body relative to a second reference point;

emulate the first body in the three-dimensional environment by changing one or more attributes of a first cursor, wherein the first cursor comprises a first plurality of nodes configured as a first point hierarchy;

emulate the second body in the three-dimensional environment by changing one or more attributes of a second cursor, wherein the second cursor comprises a second plurality of nodes configured as a second point hierarchy;

position the first cursor and the second cursor within the virtual world; and

integrate the first cursor and the second cursor and the virtual world into a database.

67. The kit as recited in claim 66, further comprising one or more display devices configured to display images of the virtual world.

68. The kit as recited in claim 66, further comprising one or more audio display devices configured to produce three-dimensional sounds as part of the virtual world.

69. The kit as recited in claim 66, wherein said first and second body part sensing means are selected from the group consisting of: eye tracking devices, cameras, clothing-based sensors, force feedback devices, ultrasonic tracking devices, voice recognition devices, video tracking devices, keyboards, pneumatic input devices, facial expression sensors, magnetic tracking sensors, infrared tracking devices, and telemetry sensing devices.

70. The kit as recited in claim 66, wherein said first cursor and said second cursor represent objects selected from the group comprising: machines, articles of manufacture, animals, molecules, human figures, human body parts, tools, and three-dimensional objects.

71. The kit as recited in claim 66, further comprising one or more computer systems configured to:

execute said computer software program;

receive said first set of data and said second set of data; and

generate an image of the virtual world for output.

72. A computer system configured to creating an interactive, multi-user virtual reality world, the computer system comprising:
a central processing unit;

a memory coupled to the central processing unit;

one or more display processors; and

a computer software program embodied on a computer-readable media, the program comprising a plurality of instructions, wherein the instructions are configured to:

process a first set of data from a first body part sensor, wherein the first set of data represents the physical status of a first part of a first body relative to a first reference point;

process a second set of data from a second body part sensor, wherein the second set of data represents the physical status of a second part of a second body relative to a second reference point;

emulate the first body in the three-dimensional environment by changing one or more attributes of a first cursor, wherein the first cursor comprises a first plurality of nodes configured as a first point hierarchy;

emulate the second body in the three-dimensional environment by changing one or more attributes of a second cursor, wherein the second cursor comprises a second plurality of nodes configured as a second point hierarchy;

position the first cursor and the second cursor within the virtual reality world; and

integrate the first cursor and the second cursor and the virtual reality world into a database.

73. The computer system as recited in claim 72, further comprising two or more body part sensors configured to be coupled to said central processing unit, wherein said body part sensors are selected from the group consisting of: eye tracking devices, cameras, clothing-based sensors, force feedback devices, ultrasonic tracking devices, voice recognition devices, video tracking devices, keyboards, pneumatic input devices, facial expression sensors, magnetic tracking devices, infrared tracking devices, and telemetry sensing devices.

74. The computer system as recited in claim 72, further comprising two or more display devices configured to be coupled to said central processing unit and configured to display images of the virtual world generated by said central processing unit.

75. The computer system as recited in claim 72, further comprising two or more audio display devices configured to be coupled to said central processing unit and configured to reproduce sound from the virtual world generated by the central processing unit.

76. The kit as recited in claim 70, wherein said first cursor and said second cursor represent objects selected from the group comprising: machines, articles of manufacture, animals, molecules, human figures, human body parts, tools, and three-dimensional objects.

77. A method for interacting with a virtual world comprising:

processing a first set of data from a first sensor, wherein the first set of data represents the physical status of a part of a first body relative to a first reference point;

processing a second set of data from a second sensor, wherein the second set of data represents the physical status of a part of a second body relative to a second reference point;

emulating the first body in the virtual world by changing one or more attributes of a first cursor, wherein the first cursor comprises a first plurality of nodes configured as a first point hierarchy;

emulate the second body in the virtual world by changing one or more attributes of a second cursor, wherein the second cursor comprises a second plurality of nodes configured as a second point hierarchy;

calculating the position of the first cursor and the second cursor within the virtual world; and

integrating the first cursor and the second cursor into a database representing the virtual world.

78. The method as recited in claim 77, further comprising generating stereophonic three-dimensional sounds to produce the experience that a source for the sounds is located in a specific location in the virtual world.

79. The method as recited in claim 77, further comprising communicating said second set of data across a network link.

80. The method as recited in claim 79, wherein said network link is selected from the group comprising: an Ethernet link, a phone line link, an ISDN link, or a satellite link.

81. The method as recited in claim 77, further comprising communicating changes in said database across a network.

82. The method as recited in claim 77, further comprising algorithmically deriving the second set of data.

83. The method as recited in claim 77, further comprising:

generating at least a partial first image of the virtual world for said first body; and

generating at least a partial second image of the virtual world for said second body.

84. The method as recited in claim 77, wherein said first partial image is generated from a viewpoint related to the position and orientation of said first cursor in said virtual world.

85. The method as recited in claim 84, further comprising communicating said first partial image across a network.

86. The method as recited in claim 84, wherein said second partial image is generated from a viewpoint related to the position and orientation of said second cursor in said virtual world.

87. The method as recited in claim 77, wherein said physical status comprises information selected from the following group: temperature, blood pressure, heart rate, radiation, position, and orientation.

88. The method as recited in claim 77, further comprising updating the database to change objects in the virtual world in response to said first set of data and said second set of data.

89. The method as recited in claim 74, wherein said first cursor and said second cursor represent objects selected from the group comprising: machines, articles of manufacture, animals, molecules, human figures, human body parts, tools, and three-dimensional objects.